

Assessment of Structural Adequacy of Br. No. 514 DN by doing Instrumentation of One Span and FEM Analysis as per Relevant Railway codes in Prayagraj division of North Central Railway

METHODOLOGY STATEMENT

submitted to
Dy.CE/Br /Line/ALD
North CENTRAL RAILWAY

by



KDM Engineers (India) Private Limited

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Approved


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1. INTRODUCTION

1.0 Introduction

North Central Railway assigned the work of Assessment of structural adequacy of by doing instrumentation and FEM analysis as per relevant Railway codes to M/s KDM Engineers (India) Pvt. Ltd., Hyderabad, vide LOA no: Letter No: BRIDGELINE-ALD-ENGINEERING / 2025-02 / 10504010135971 dated 06.08.2025. The methodology included in this report pertains to Br no: 514 DN (3x23.77m Riveted Fish belly Plate Girder) between Chunar – Cheoki section.

Indian Railways proposed to run higher axle loaded wagons for running CC+8+2/25ton axle load wagons on existing sections. In order to assess the suitability of existing bridges and monitor the effect of increased axle loads, it is proposed to carry out instrumentation of representative bridges. RDSO laid down detailed guidelines for the instrumentation of bridges vide BS-106 R2 2023.

Br. No. 514DN is one such bridge identified by North Central Railway for assessing the suitability for running higher axle load trains and residual life of bridge by using instrumentation and condition monitoring. Br. No. 514 DN is a Fish belly Plate Girder bridge with spans of 3x23.77m located in the line of Chunar – Cheoki section in North Central Railway. Table 1.1 gives the salient features of the bridge and Fig. 1.1 illustrates the geographical location of the bridge.



Fig. 1.1 Geographical location of the bridge no. 514DN (25°07'35.9"N 82°36'47.2"E)

Table 1.1: Salient features of bridge

Bridge Number	:	514DN
Location co-ordinates	:	25°07'35.9"N 82°36'47.2"E
Span Details (clear span)	:	3x23.77m
Skew/Straight bridge	:	Straight
Type of Superstructure	:	Fish belly Plate Girder
Type of Substructure	:	Stone Masonry with RCC Jacketing
Description of the main use of the bridge	:	Railway
Width of the bridge/deck	:	2.6m
Standard of loading for bridge	:	BGML
Type of bearings/conditions	:	Centralized bearing
Year of Construction	:	1926

1.1 Objective of the work

Carrying out instrumentation of Br. No. 514 DN (3x23.77m) for monitoring the effect of increased loads and higher axle loads for running of CC+8+2T/25T axle load wagons.

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Span 2 is proposed to be instrumented after discussion with Railway officials during site visit.

In this study, two rounds of instrumentation are proposed. The first round will give the general picture of the bridge behavior and second round is planned subsequently for reconfirmation and reconciling of results obtained in the first round. Data collection for recording the bridge response for duration of 72 hours will be done for selected train of normal traffic during instrumentation of bridges.

1.2 Scope of the work

1. Carrying out instrumentation of bridges for monitoring the effect of higher axle loads for running of CC+8+2T/25T axle load wagons on bridge components.
2. Measurement and analysis of a) superstructure for frequency, deflections, and strains. b) substructure for tilt and strains, c) bearings for load transfer, displacements and strains.
3. Development of numerical model and validation for various load combinations (static and dynamic loadings including temperature effects).
4. Performing fatigue analysis using validated model and 25t-2008 loading by suitable method (SN curve etc.) as per BS 91 guidelines.
5. Perform numerically the structural modification studies to determine cost-effective rehabilitation/strengthening scheme design and drawings for bridges, if needed for running heavier axle load.
6. Testing of the mechanical properties of masonry piers using core cutting or flat jack methods if the masonry pier is not RCC jacketed.
7. Submission of reports

1.3 Items to be covered as per the objective

- (a) Stresses at critical locations
- (b) Deflections at critical locations

- (c) Dynamic augment
- (d) Acceleration & Natural Frequency of Bridge/Components
- (e) Longitudinal loads coming on bearings/ and substructures and proportion transferred to approaches
- (f) Tilting of abutments/ piers and stresses in the sub-structure
- (g) Fatigue analysis
- (h) Load Ratings/Load Factors
- (i) Comparison between numerical model values & values obtained from Instrumentation for test train ii) Instrumentation values to the permissible values as per code provisions

1.4 Prerequisites as per conditions of contract-to be arranged by Railways

- **Detailed drawings of the bridge:** GA drawing and structural drawings/RDSO drawings
- **Properties of the materials used:** The material properties of bridge elements.
- **Design documents:** Any design document related to the design of bridge.
- **Bridge history:** Damages in the bridge structure if occurred, intermediate repairs or strengthening of bridge carried out in the past.
- **Load history:** Details of all trains passed over the bridge till date.
- Periodic inspection reports.
- Arrangement of test train with known axle loads

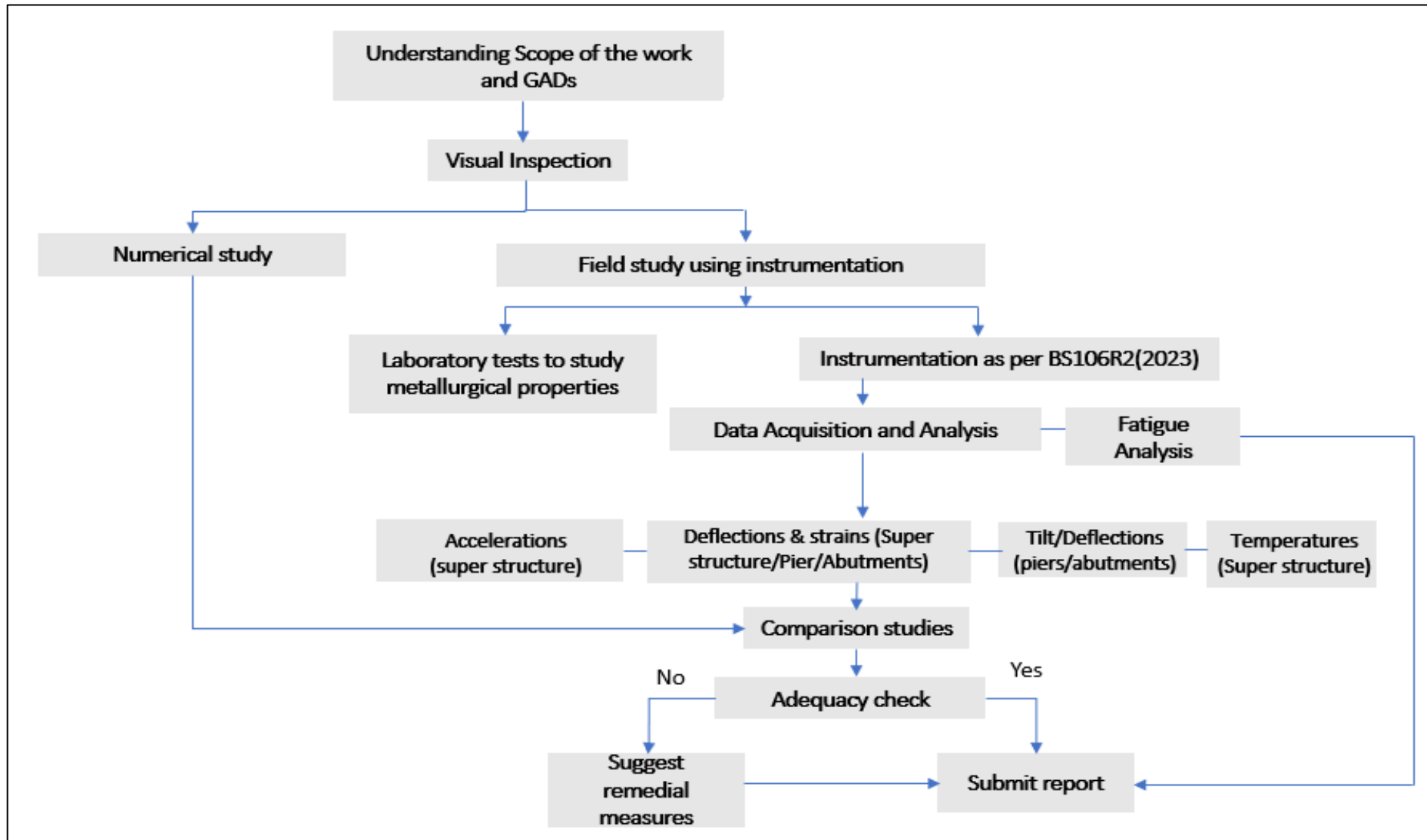


Fig. 1.2 Methodology flowchart

2. FIELD INVESTIGATIONS

2.0. Visual Inspection

Visual inspection is an essential for bridge maintenance and management. It involves the physical examination of the bridge by trained inspectors to assess its overall condition to identify potential issues and determine the need for repairs or maintenance activities. Here are some key aspects of visual inspection in bridges:

- Record the current physical and functional condition of the bridge.
- Measure critical dimensions required during developing the numerical model.
- Confirm that any previous repairs carried out are functioning satisfactorily.

During each round of instrumentation, the physical condition of the bridge superstructure members, substructure members, track condition, approach condition, etc. will be inspected and recorded.

2.1 Preliminary Visit

Team of 2 engineers from KDM Engineers (India) Pvt. Ltd., Hyderabad, accompanied by SSE/Br/PRYJ visited the site on 24th August 2025 for preliminary field investigations and to measure the geometrical dimensions of structural elements. Inspection details are given in Table 2.1.

Table 2.1: Field visual investigation details and observations

Date of Preliminary visit	24.08.2025
Site visit team details	Mr. Akhil Ananda Reddy P, Structural Engineer (KDM) Mr. Sathish Yadav M, Structural Engineer (KDM) Mr. Paramahans Singh , SSE/Br/PRYJ
Year of construction	1926
Bridge No.	514 DN
Between Stations	Chunar - Cheoki
Name of the bridge	Khajuri River bridge
Bridge span details	3x23.77m

Proposed span	Span 2 (P1, P2)
Effective span	25.85m
Is the bridge skew or on curve	No
Is the bridge provided camber	-
Operating Speed (kmph)	130kmph
Type of girder	Fish belly Plate Girder
Re-Girdering Year	NA
No of girders per span	02
No of track on bridge	01
Standard of loading	BGML Loading
Material properties	-
Abutment height	8300mm
Bearing details	Centralized bearing
Type of pier	RC
Condition of bridge	Good
Condition of abutment	Good
Condition of bearing	Good
Clear height between rail level to girder bottom	2.93m
Damage of members of span such as buckling, cracks, distortion, deterioration etc.,	Corrosion observed at various locations
Other remarks	No



Fig. 2.1: Span of bridge



Fig. 2.2: Bottom and cross bracings of bridge



Fig. 2.3: Centralized bearings of bridge



Fig. 2.4: Stone masonry with RCC jacketing of the Pier

3. NUMERICAL MODELLING & ANALYSIS

3.0 Introduction

Development of numerical model and analysis for various load combinations:

- In this methodology, a preliminary numerical model is developed using MIDAS, based on the existing geometry, drawings supplied by railways, material properties, boundary conditions, and the loads that are applied to the bridge. The dimensions are obtained during the field investigation. Span no.2 of length 23.77m is considered for the study.
- The comparison of the results between the numerical model and instrumentation will be drawn for both the current axle load and higher axle load.
- Primarily, modal analysis to update the support conditions of the span using instrumentation.
- The updated model shall be analyzed for dead load, superimposed dead load and live loads of static and dynamic conditions. In this process, dynamic characteristics of the span will be extracted. Static loading conditions include the test train loading placed at static condition on the test span. Performing static load analysis of track vehicles as per IRS loads specified in Bridge rules to imply the test train loads of bridge instrumentation. Stresses and displacements at critical locations of bridge super structure shall be identified for IRS loadings.
- Later, the numerical model will be validated by performing time history analysis for test train loads to estimate the deflections and stresses in structural members and will be compared with the responses obtained from the instrumentation.
- The validated model will be used i) to identify stresses and deflections for higher loads and higher speeds in the section and ii) to estimate the remaining fatigue life of critical members under higher loads.

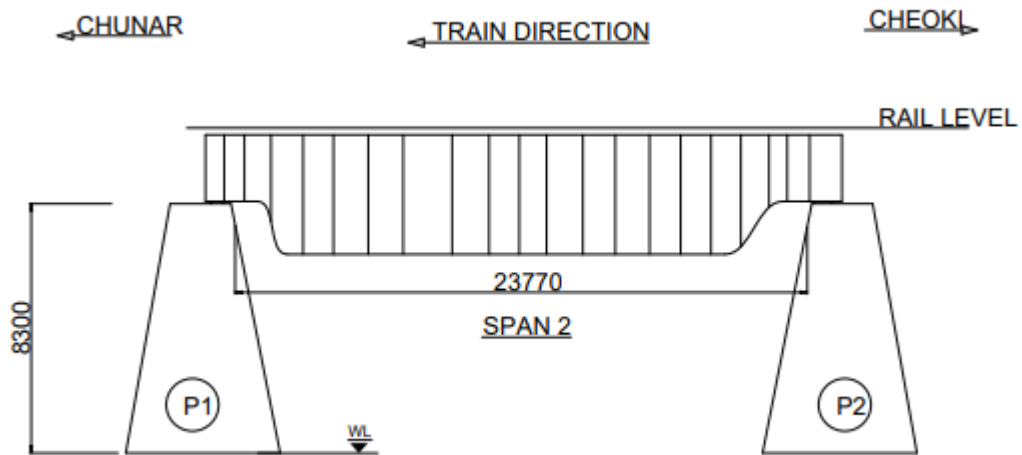
3.1 Assumptions:

- a) The present numerical models are developed based on elemental conditions.
- b) Elastic links are given for the centralized bearings. Support fixity will be updated by integrating the data from instrumentation.
- c) The proposed numerical analyses are performed under assumptions of homogeneity and linearity.

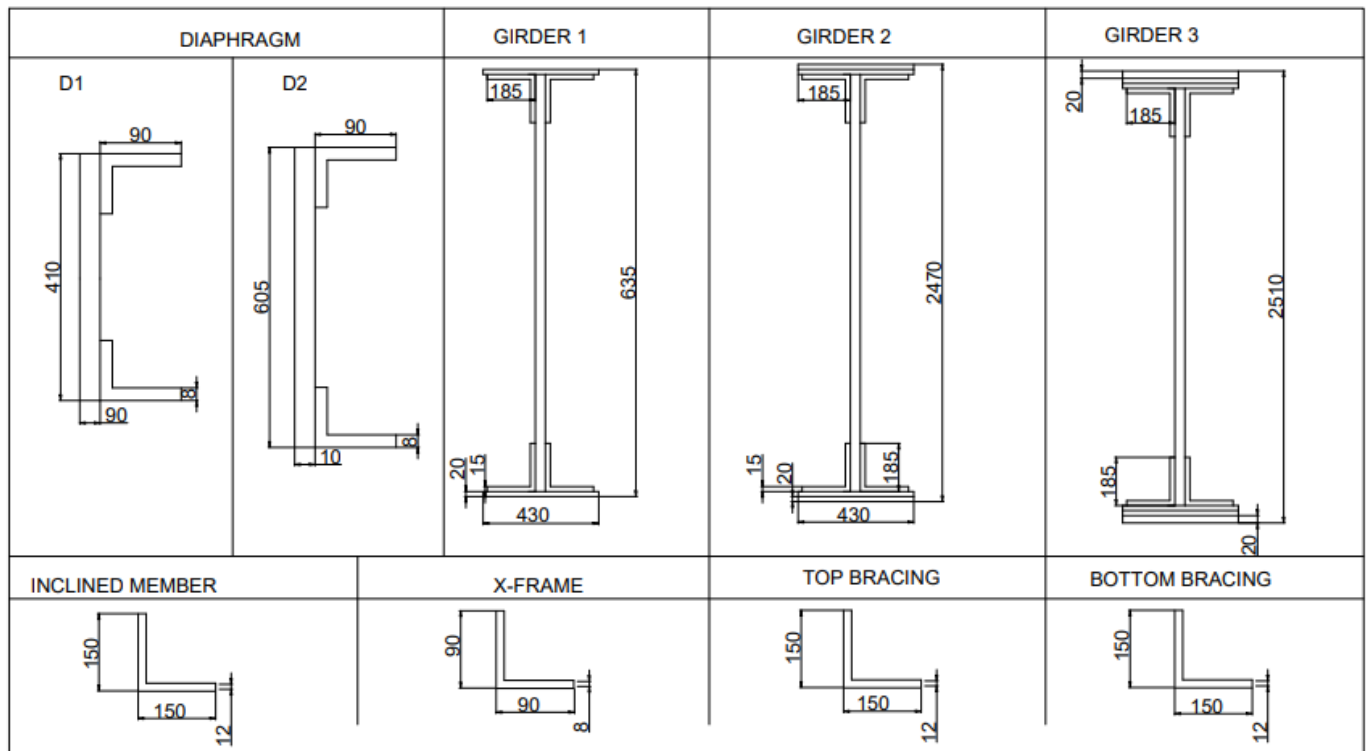
3.2 Section Details

a) Superstructure:

The FE model of superstructure is developed as per dimensions of the superstructure given in Annexure I.



a)



(b)

Fig. 3.1(a): Elevation of span 2 **(b):** Member sectional (1-1) details of bridge components

Table 3.1: Member sections considered in numerical modelling

S.No.	Members	Sections	Quantity	Dimensions (mm)
1	Girder-1	Top Plate	1	430x20
		Bottom Plate	1	430x20
		Web	2	595x30
		L-Angle	4	200x200x15
2	Girder-2	Top Plate	2	430x20
		Bottom Plate	2	430x20
		Web	2	2390x30
		L-Angle	4	200x200x15
3	Girder-3	Top Plate	3	430x20
		Bottom Plate	3	430x20
		Web	1	2390x30
		L-Angle	4	200x200x15
4	Top Bracings	L-Angle	11	150x150x12
5	Vertical Bracings	L-Angle	22	90x90x8

6	Bottom Bracings	L-Angle	9	150x150x12
7	Diaphragm-1	L-Angle	2	90x90x8
		Additional Plate	1	410x10
8	Diaphragm-2	L-Angle	2	90x90x8
		Additional Plate	1	605x10
9	Inclined bracing	L-Angle	1	150x150x10

3.3 Material properties:

Finite Element model is developed considering the assumed material properties for superstructure as E250 B0 of IS 2062(2011).

3.4 Bearing Condition:

Centralized bearings (Fig. 2.3) are observed at site and the same shall be considered for the numerical modelling. Fig. 3.2 shows the FEM model of the bridge span.

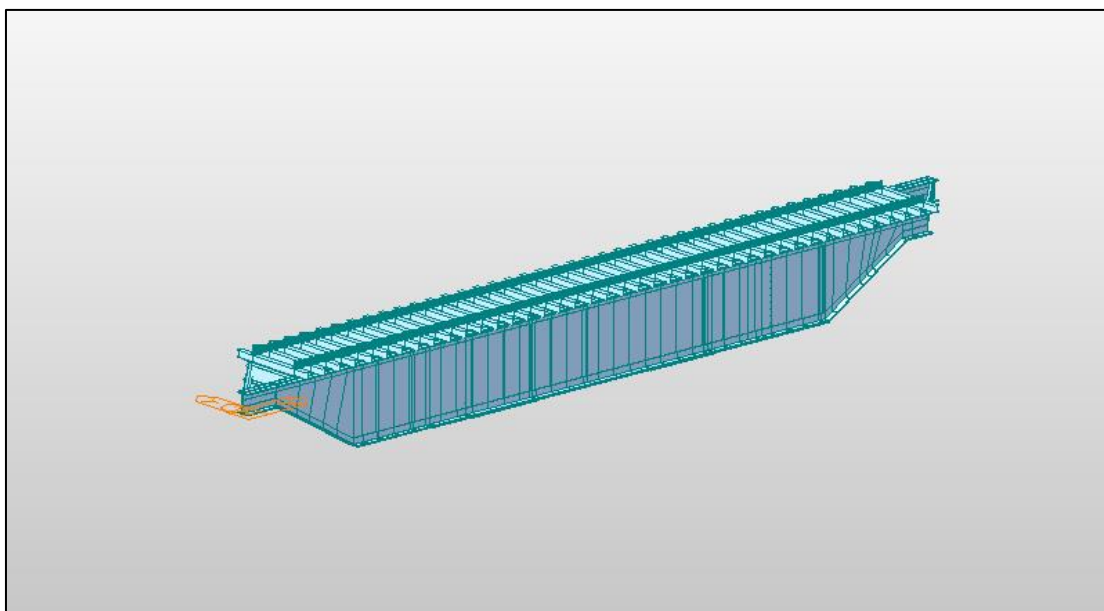


Fig. 3.2: Finite element model of span 2

4. INSTRUMENTATION SCHEME

4.0 Introduction:

The aim of instrumentation is to record the parameters which significantly influence the behavior of the bridge. Instrumentation provides valuable data on the bridge's performance over time. Also, instrumentation is used to validate the design assumptions and models. The data collected from instrumented bridges can be compared to the design values. Any discrepancies can be addressed to improve future designs. Engineers can analyze this data to assess the bridge's behavior under various load conditions. Guidelines given in BS 106 R2 (2023) will be adopted for the instrumentation scheme. The below table gives the details of the instrumentation.

Table 4.1: Details of Instrumentation

S. No.	Name of the Instrument	Purpose
1	Accelerometers	Measures accelerations
2	Temperature sensors	Measures temperature
3	LVDTs	Measures vertical and horizontal displacements
4	Strain gauges	Measures strain on superstructure and substructure
5	Laser/total station	Measures vertical deflections
6	Tilt meter	Measures tilt of abutment/pier

4.1 Measurement of acceleration

Accelerometers are proposed to measure the acceleration response to the applied dynamic load. It is proposed to place the accelerometers at $L/4$, $L/2$ and $3L/4$ (L -effective span) on the bottom flange of main girders (LHS and RHS) as per BS 106 R2 (2023).

4.2 Measurement of temperature

Thermocouples are proposed to be employed for the purpose of measuring the temperature on various components of the superstructure including primary and secondary members and rails.

4.3 Measurement of vertical deformations

Laser/total station is proposed to be employed to measure the deflection at the mid span both LHS and RHS. Fig. 4.1 shows the sensor locations for accelerometer, thermocouples and laser/ total station.

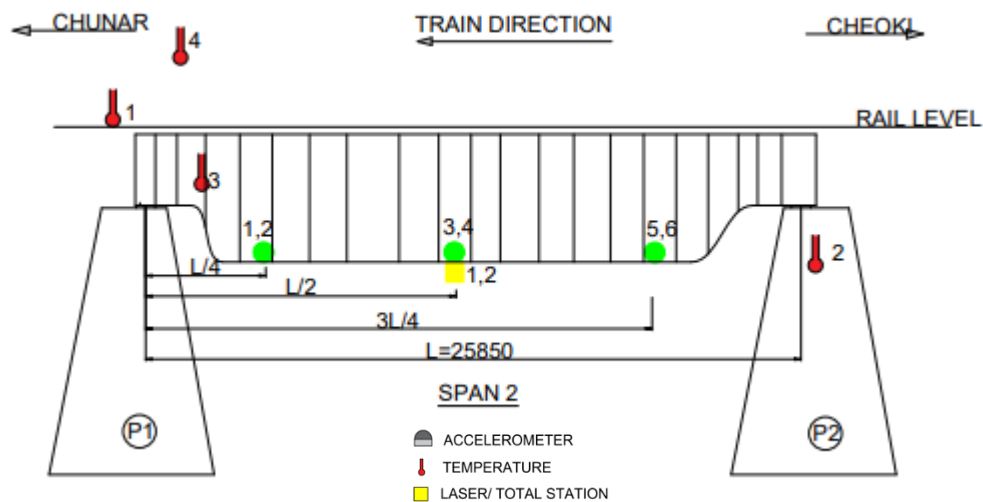


Fig. 4.1: Positioning of accelerometer, thermocouples and laser/total station

4.4 Measurement of tilt and deflections

Bearing displacements are to be measured in the direction to the traffic by placing LVDTs (Linear Variable Differential Transformer) on the traffic side of Centralized bearing of the span 2. Strain gauges are provided on the bearing perpendicular to the traffic directions. As per the guidelines of BS 106 R2 (2023) (page no.18), biaxial tilt meter is to be used for the measurement of in-plane and out-of-plane tilts of the pier. Layout of LVDTs, tilt meters and strain gauges is shown in Fig. 4.2. s

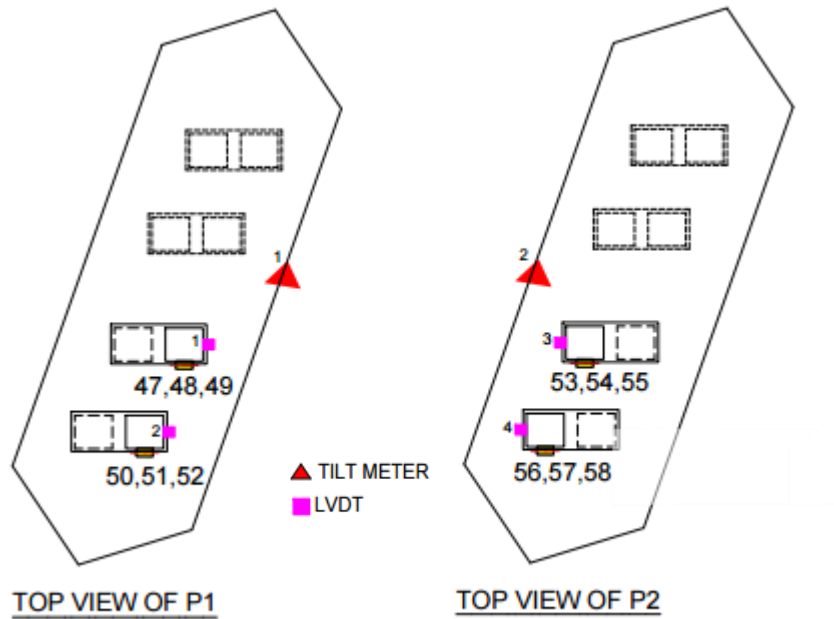


Fig. 4.2: Tilt meters at pier & LVDT

4.5. Measurement of strains

Strain gauges are to be used to measure the axial and bending strains when the span is subjected dynamic load. It is proposed to place the strain gauges at the locations shown in Fig. 4.3 to 4.6, which is in accordance with the guidelines of BS 106 R2 (2023).

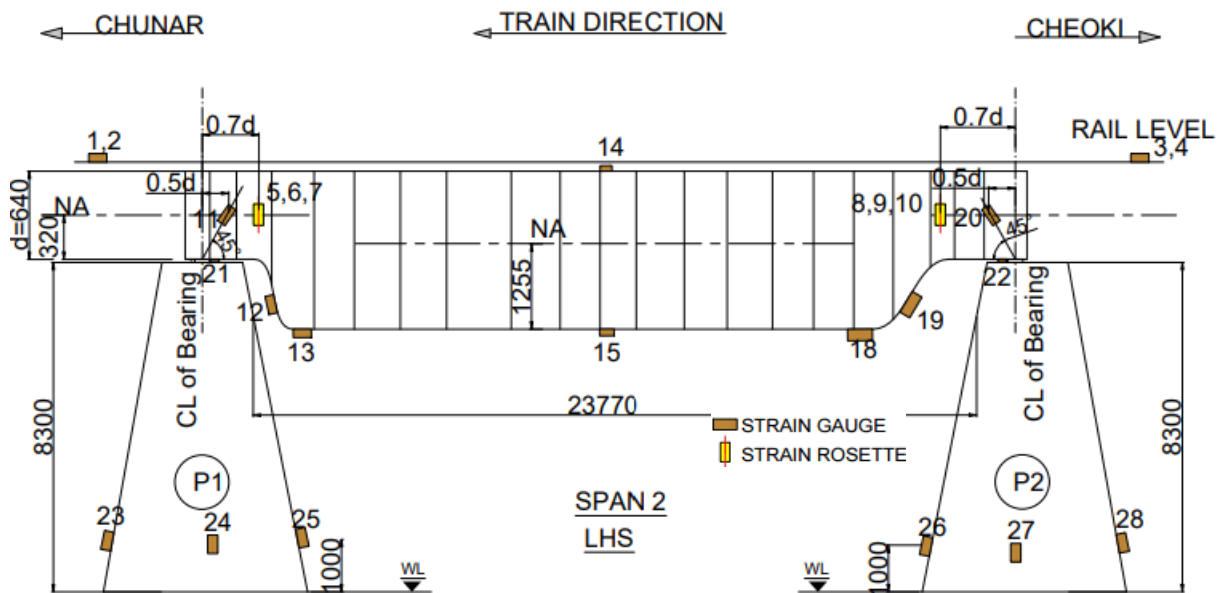


Fig. 4.3: Strain gauge locations on the girder of span 2 (LHS)

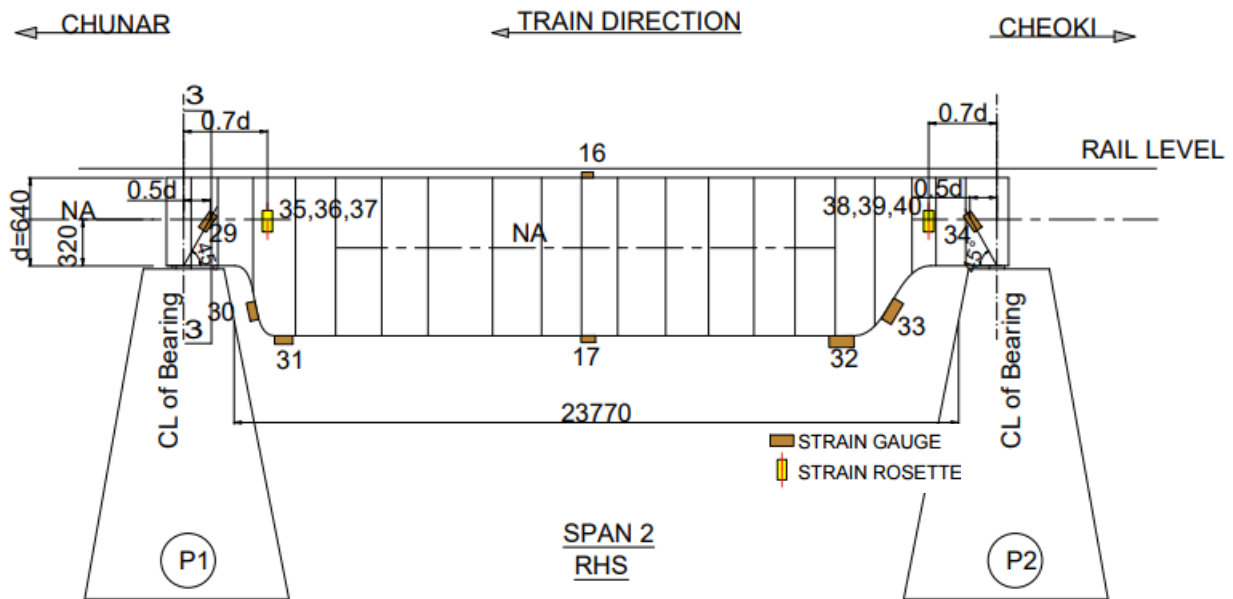


Fig. 4.4: Strain gauge locations on the girder of span 2 (RHS)

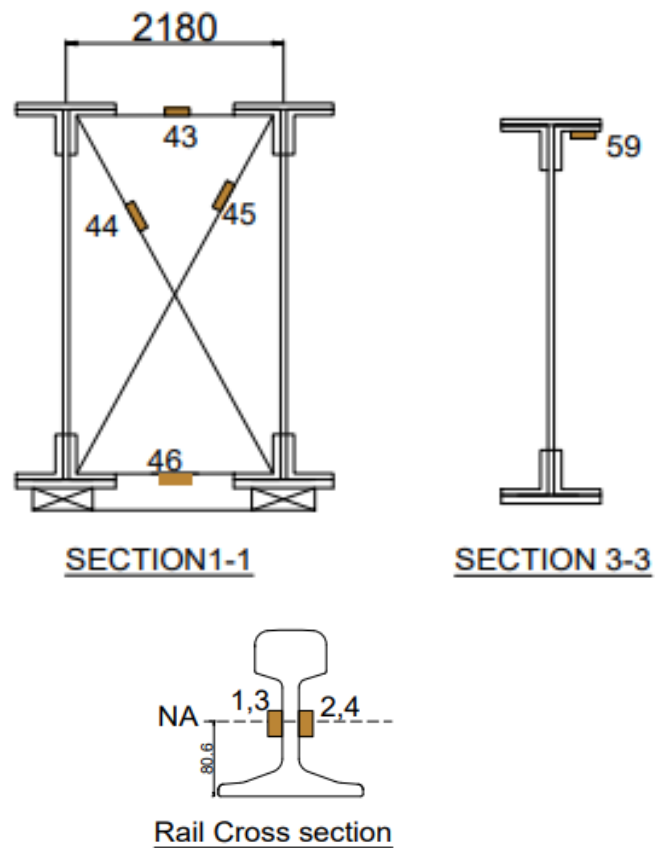
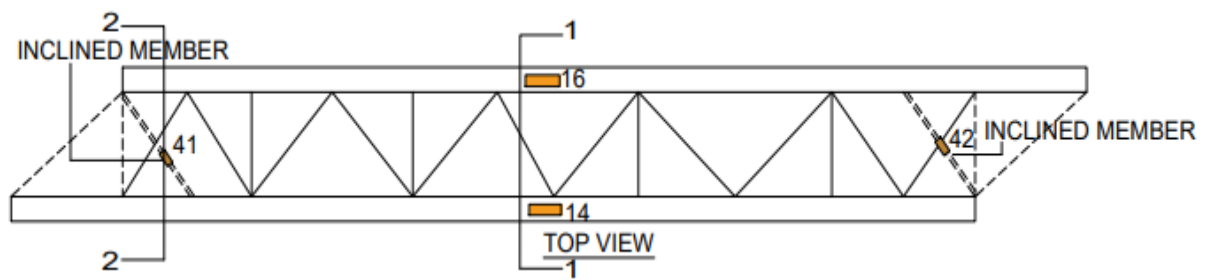
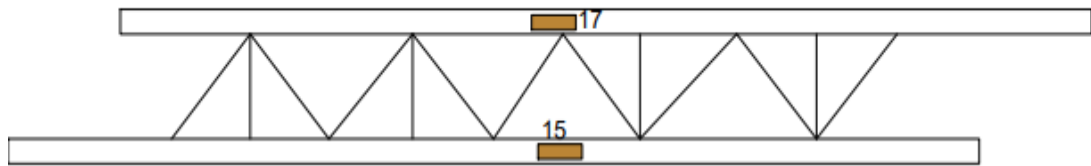


Fig. 4.5: Strain gauge locations on cross frame and bracings



(a)



(b)

Fig. 4.6: Strain gauge locations on Top and bottom of girder and top lateral bracings

Note: LVDT/Strain gauge on the pier/abutments can be placed as per the site conditions.

Table 4.2: Sensor quantity and positions per span

Sensors	Quantity	Position	Purpose	Inference
Accelerometers	6	At L/4, L/2 and 3L/4 on both sides of the girder (06)	Accelerations	Fundamental frequencies of the superstructure
Strain Gauges on girder (Strain rosettes included)	59	At 0.7d from center of bearing on the neutral axis of both sides of the girder (strain rosettes 4x3)	Principal stresses thereby shear stress	To check for shear in web of the girder
		a) At mid-height of the web, positioned at an angle of 45° with horizontal offset of 0.5d from the centerline of the bearing, on both girders end (2x2) b) Near bearing both sides for one girder (2)	strains on the girder	shear in the girder near bearing
		On the bearing sides-along the traffic direction (4x3)	Principal stresses thereby shear stress	To check for shear in Bearings

Sensors	Quantity	Position	Purpose	Inference
		On the girder bottom where cross section changes (2x2x2)	Bending strains	Bending compression /tension
		On top end bracings (02)	Strains	Forces on the bracings
		On the Bracings at sec A-A (04)	Strain on bracings	Forces on bracings
		On the top and bottom flanges of steel girder at midspan (4)	Bending strains	Maximum Bending compression /tension
		At 1/3 rd height of the pier (3+3)	Bending strains	Maximum bending compression /tension
		Bottom of top flange near the support	Bending strains	Bending compression /tension
		On one rail at neutral axis (04)	Longitudinal strain	Longitudinal forces coming to the bearings
LVDT	4	On the Two sides of bearings (02)	Displacements	Bearing movements and pier deflections
Tilt meter	2	On the pier (02)	Tilts	Rotations of pier
Laser/Total station	2	At bottom of mid span on both sides (02)	Displacements	Vertical deflection of the girder
Temperature Sensors	4	On the girder, pier and ambient (04)	Temperatures	Temperature difference (ΔT)

4.6 Structural modification Rehabilitation/ Strengthening scheme

After analyzing the instrumentation results and numerical studies, strengthening schemes can be proposed if required. The detailed strengthening drawings will be submitted

4.7 Remaining life assessment:

4.7.1 Procedure for fatigue life assessment

1. The selection of critical components for the fatigue study based on the data from instrumentation. (Identification and analysis of critical components using the data obtained from instrumentation to study their response under fatigue loading)
2. A test sample from the bridge under evaluation will be tested for the metallurgical composition, if required.
3. The total fatigue life for critical member will be estimated as per BS 91 guidelines.

4.8 Test train load capacity

Loading scheme: It is proposed to provide Heaviest Axle Load Goods Train plying in the section hauled by Double/Triple Headed Locos which generates maximum Tractive Effort & Braking Force.

Test Train Requirements:

Multi/consist diesel loco + 55 BOXN Wagons loaded to CC+8+2T with iron ore + Loco for pulling back of rake.

WDG3A + WDG3A + (55 BOXN Wagons loaded with iron ore to CC+8+2T) + WDG3A + WDG3A

OR

Multi/consist loco + 55 BOXN Wagons loaded to CC+8+2T with iron ore + Loco for pulling back of rake.

WAG7 + WAG7 + (55 BOXN Wagons loaded with iron ore to CC+8+2T) + WAG7 + WAG7

Test cases

1. Static loads:

- Keeping the first axle of the first wagon in static state on the span at centerline of bearing

2. Braking force:

- Braking the test train using dynamic brakes at approach and mid span when running at maximum sectional speed.

3. Tractive forces:

- Loco accelerating at approach and mid span with maximum allowable tractive force. **For generating the required tractive effort, suitable number of wagons can be brake- binded, by applying hand brakes in consultation with Sr. DME(C&W).**

4.Speed test: Train running at a uniform slow, medium and section design speed.

NOTE:

1. Same train configuration can be used for speed test
2. Applied tractive and braking forces (test cases 2&3) must be provided by witnessing BRI during testing.

5. FINAL REPORT CONTENTS

The final report will be submitted in two stages. In the first stage, the report will be prepared based on results of the first round of instrumentation and hence this report will be treated as preliminary report for general reference. In the second stage, the final report will be submitted after the second round of instrumentation duly compiling the data from both the rounds of instrumentation and this report will be treated as final.

The final report consists of the following details:

- **Executive summary:** A brief description of the project, process of work execution and summary of conclusions and recommendations (if any).
- **Introduction:** A comprehensive depiction of the bridge's superstructure and substructure for the proposed span is provided. Additionally, all necessary parameters for the numerical modelling process such as material properties, component dimensions etc. are incorporated.
- **Field Investigation:** Visual inspection documentation of the current condition of the bridge's superstructure, substructure, tracks, approaches, bearings and other components is required.
- **Methodology:** A detailed methodology of the steps involved during the analysis of the span subjected to higher axle load is proposed along with the details of the test train which include its speed and axle load.
- **Instrumentation and data acquisition:** A detailed instrumentation scheme for testing higher axle loads is presented and various sensors used for every structural parameter is mentioned along with data acquisition setup.
- **Data analysis and Interpretation:** The data acquired from the site shall be analyzed to identify dynamic parameters and structural responses.

- **Numerical modelling:** A Finite element software shall be utilized to model the selected span in accordance with site-measured data and drawings provided by railways. The finite element model developed from preliminary study shall be updated using the results extracted from instrumentation of the selected span and validated.
- **Residual fatigue life:** The remaining life of the bridge span is assessed according to the General Guidelines BS91 provided by RDSO and steel bridge code.
- **Conclusions:** The conclusions derived from the numerical analysis and instrumentation data will be utilized to evaluate the state of the proposed span in accordance with the project's scope.
- **Rehabilitation/Strengthening:** The rehabilitation/strengthening of the bridge or part of the bridge will be suggested based on the conclusions.

Approved

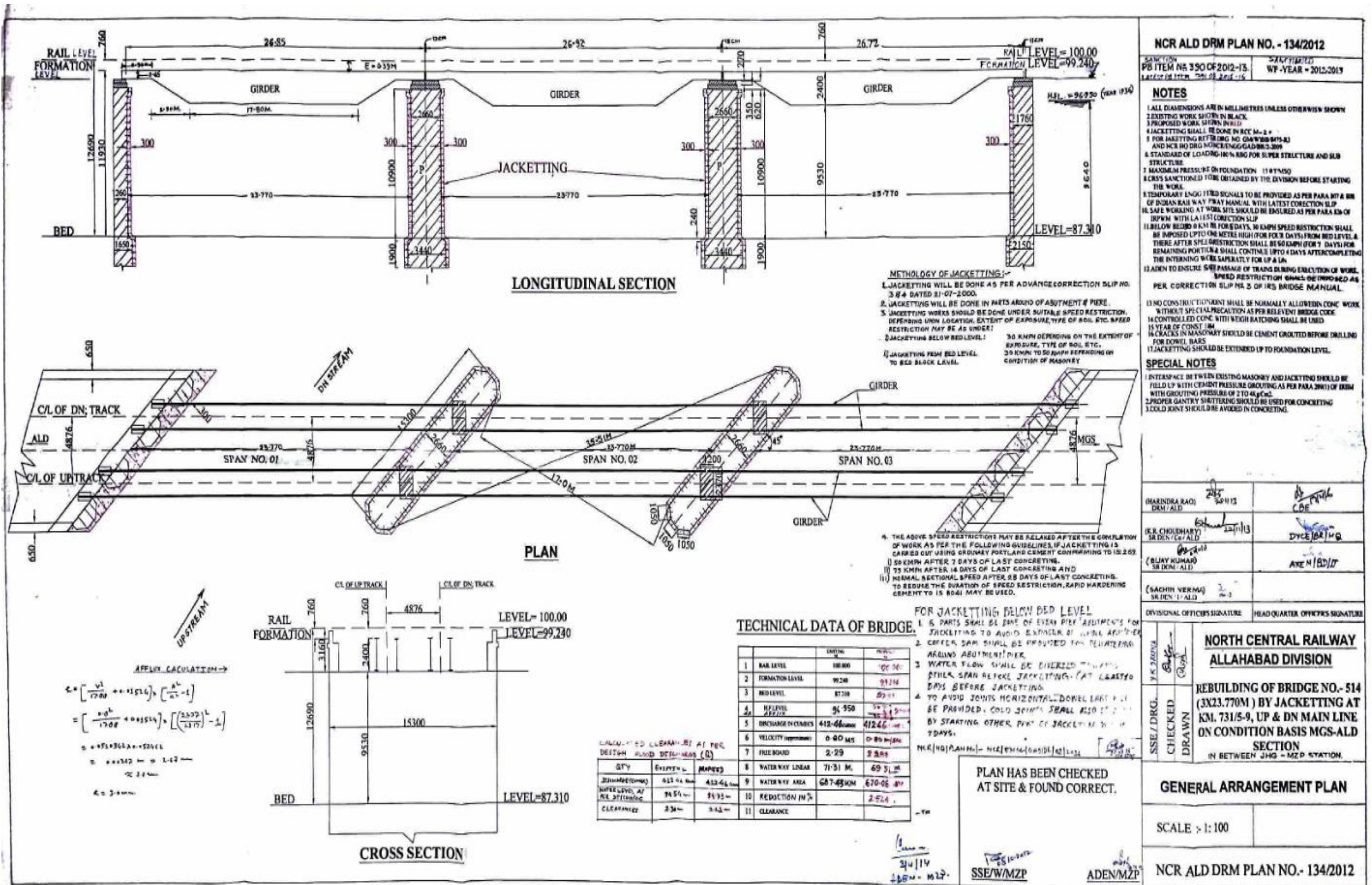

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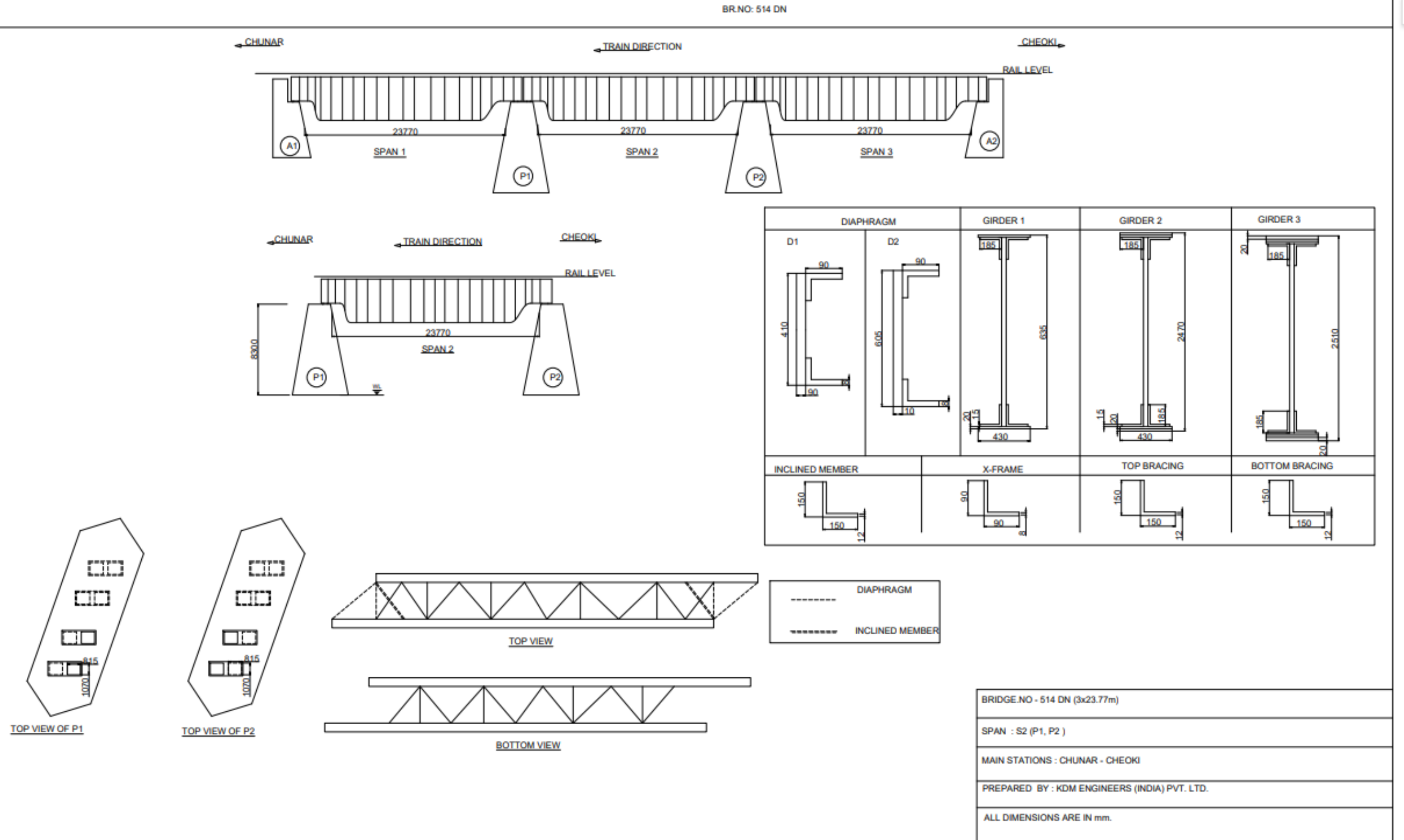
6. REFERENCES

- BS 106 R2 2023: GUIDELINES FOR INSTRUMENTATION OF BRIDGES
- BS 91: GUIDELINES FOR ASSESSMENT OF RESIDUAL FATIGUE LIFE OF STEEL GIRDER BRIDGES
- BRIDGE RULES: RULES SPECIFYING THE LOADS FOR DESIGN OF SUPER-STRUCTURE AND SUB-STRUCTURE OF BRIDGES AND FOR ASSESSMENT OF THE STRENGTH OF EXISTING BRIDGES
- STEEL BRIDGE CODE (2017): INDIAN RAILWAY STANDARD CODE OF PRACTICE FOR THE DESIGN OF STEEL OR WROUGHT IRON BRIDGES CARRYING RAIL, ROAD OR PEDESTRIAN TRAFFIC

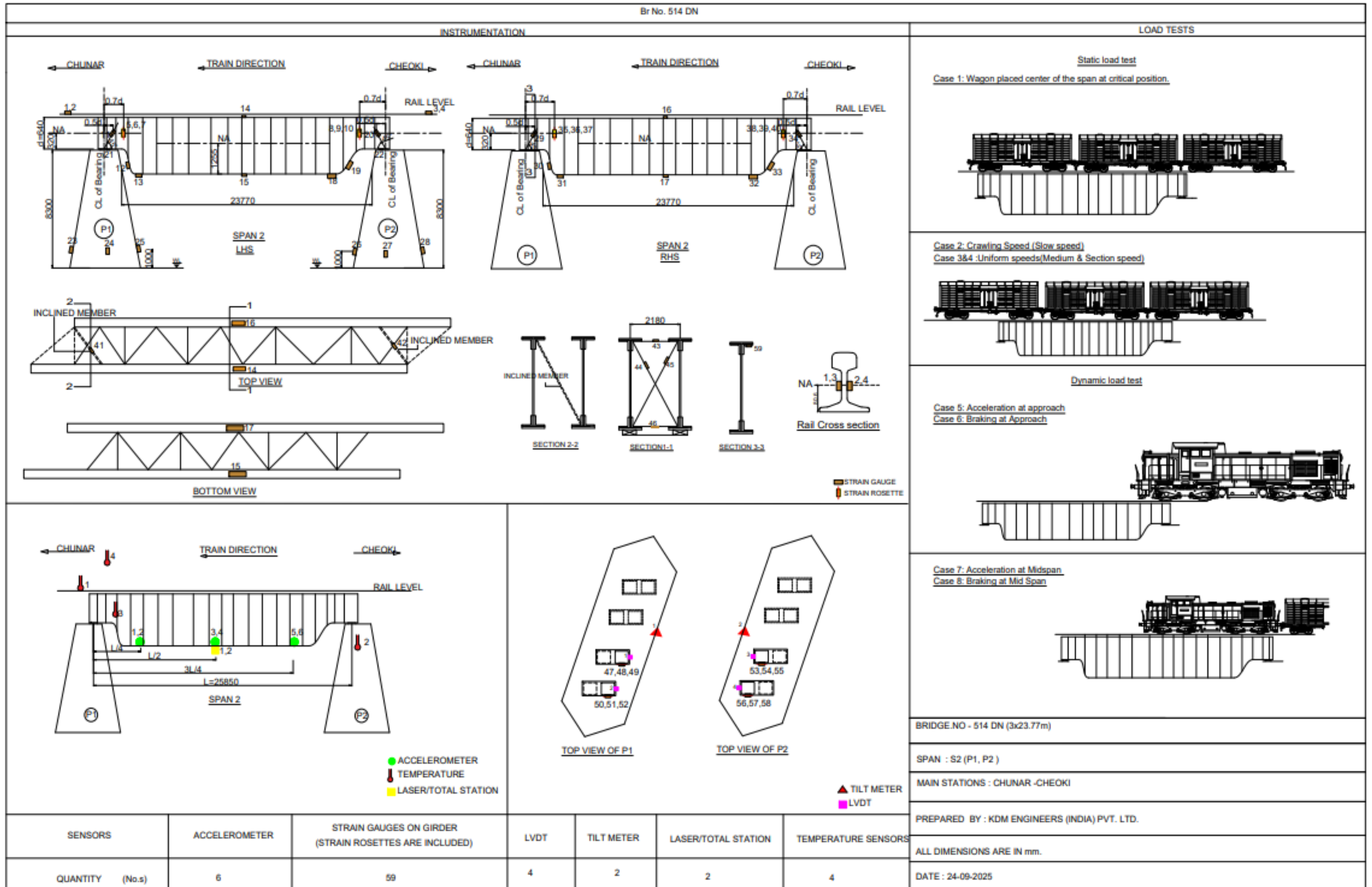
ANNEXURE I: Drawings of Br.No.-514 DN from Railways



ANNEXURE II: Built-up drawing as per field measurements of Span 2 of Bridge No. 514 DN



ANNEXURE III: Layout of Instrumentation positions for data-acquisition



ANNEXURE IV: Details of Field Visual Investigation

Bridge Details Table					
Railways	Northern Central Railway		Date	24/08/2025	
Section	CAR-COI		Bridge No.	514 DN	
Location	25°07'35.9"N 82°36'46.9"E		Total Span	3	
Bridge Description	3x23.77 m		Test Span	Span 2	
Strengthening			Design Loading	BGML	
Bridge Orientation	One direction		Upstream Direction	DN	
Nearest Station	End A	Jhingura	Year Built	1926	
	End B	Mirzapur	Rail Weight	60 kg/m	
Grade	On Bridge	Level	Curvature	On Bridge	0°
	Approach A	Level		Approach A	0°
	Approach B	Level		Approach B	0°
Location		Approach A	Bridge	Approach B	
Condition of Rail		OK	OK	OK	
Condition of Rail Joints		OK	OK	OK	
Condition of Rail Fasteners		OK	OK	OK	
Rail to Sleeper Fastener Type		Elastic clip	Elastic clip	Elastic clip	
Condition of Rail Alignment		Good	Good	Good	
Sleeper Type		Concrete	H-beam	Concrete	
Condition of Sleeper		OK	OK	OK	
Condition of Sleeper Fastener		OK	OK	OK	
Sleeper to Girder Fastener Type		Bolted	Bolted	Bolted	
Ballast Cushion		N/A			
Abutment Height		8.3m	Abutment Material	Stone masonry	
Condition of Abutment		OK			
Pier Height		8300mm (as per accessibility at P1)	Pier Material	Stone masonry	
Condition of Pier		OK			
Bank Height		-			
Type of Bearing		Centralized Bearing	Fabrication Year		
Condition of Bearing		OK			
Condition of Girder		Visually OK (corroded at few locations)			
Condition of Cross Frames		Visually OK			
Condition of Lateral Bracings		Visually OK(corroded at few locations)			

ANNEXURE V: Images of the on-site investigation



Fig. AV.1: Field visit of KDM representatives and railway officials



Fig. AV.2: Measurement of span members



Fig. AV.3: Tapered section of the Plate girder


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ANNEXURE VI
Data sheets of Instruments

PRODUCT DATA SHEET

G-Link-200: Ruggedized Wireless Triaxial Accelerometer Node

The G-Link-200 has an onboard triaxial accelerometer allowing high-resolution data acquisition with extremely low noise and drift. Derived vibration parameters allow for long-term monitoring of key performance indicators while maximizing battery life.

The MicroStrain wireless sensor networks enable simultaneous, high-speed sensing and data aggregation from scalable sensor networks. Our wireless sensing systems are ideal for test and measurement, remote monitoring, system performance analysis, and embedded applications.

Users can easily program nodes for continuous, periodic burst, or event-triggered sampling with the SensorConnect software. The optional web-based SensorCloud interface optimizes data aggregation, analysis, presentation, and alerts for sensor data from remote networks.

HIGH PERFORMANCE SENSING

- On-board triaxial accelerometer with ± 2 to ± 40 g measurement range
- Extremely low noise on all axes $25 \mu\text{g}/\sqrt{\text{Hz}}$ or $80 \mu\text{g}/\sqrt{\text{Hz}}$
- User-configurable low and high pass filters
- On-board temperature sensor
- Standard Amusement Ride Characterization Test version available.



RUGGED AND WATERPROOF

- IP-67 weatherproof enclosure
- -40 to $+85^{\circ}\text{C}$ operating temperature
- Stainless steel base
- Bolt or magnetic mount

RELIABLE DATA COLLECTION

- Lossless, synchronized, and scalable networks using LXRS or LXRS+ protocol
- Remotely configure nodes and view sensor data with SensorConnect (PC), SensorCloud (web), or MSCL (API library)

CONFIGURE FOR MANY APPLICATIONS

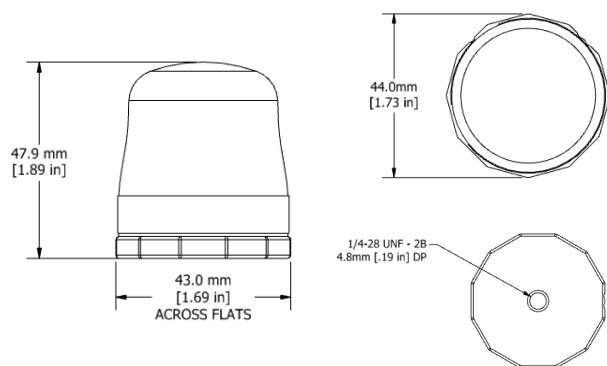
- Output raw acceleration waveform data, tilt, or derived vibration parameters (Velocity, Amplitude, Crest Factor)
- Up to 4096 Hz sampling
- Continuous, periodic, or event-triggered operation
- Transmit data real-time and/or save to onboard memory

APPLICATIONS

- Vibration monitoring
- Condition based maintenance (CBM)
- Impact and event monitoring
- Health monitoring of rotating components, aircraft, structures, and vehicles
- Standardized Amusement Ride Characterization Test (SARC Test): Model G-Link-200-R
- ASTM F2137-18 Compliant model: G-Link-200-R

MICROSTRAIN G-LINK-200 SPECIFICATIONS

Analog Input Channels		
Measurement range	8 g	40 g
	±2 g, ±4 g, or ±8 g configurable	±10 g, ±20 g, or ±40 g configurable
Noise Density	25 µg/√ Hz	80 µg/√ Hz
0 g offset	±25 mg (±2 g)	±50 mg (±10 g)
0 g offset vs temperature	±1 mg/°C (typical), ±15 mg/°C (maximum)	±0.5 mg/°C (typical), ±0.75 mg/°C (maximum)
Integrated Sensors	Triaxial MEMS accelerometer, 3 channels	
Accelerometer bandwidth	DC to 1 kHz	
Resolution	20 bit	
Scale factor error	< 1%	
Cross axis sensitivity	1% typical	
Sensitivity change (temperature)	±0.01%/°C typical	
Anti-aliasing filter	1.5 kHz (-6 dB attenuation)	
Low-pass digital filter	26 to 800 Hz - configurable	
High-pass digital filter	Off to 2.5 Hz - configurable	
Physical Specifications		
Dimensions	46.6 mm x 43 mm x 44 mm	
Mounting	¼ - 28 UNF - 2B 4.8 mm [1.9 in] DP or magnet purchased separately.	
Weight	Batteries installed: 122 grams	
Environmental rating	IP67	
Enclosure material	300 series stainless steel with polycarbonate cover	



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 459 Hurricane Lane
 Williston, VT 05495 - USA

Integrated Temperature Control	
Measurement range	-40°C to 85°C
Accuracy	±0.25°C (over full range)
Sampling	
Sampling modes	Continuous, periodic burst, event triggered
Output options	Acceleration, Tilt, and Derived channels: Velocity (IPSrms), Amplitude (Grms and Gpk-pk) and Crest Factor
Sampling rates	1 Sample/hour to 4096 Hz
Sample rate stability	±5 ppm
Network capacity	Up to 128 nodes per RF channel (bandwidth calculator) http://www.microstrain.com/configure-your-system
Node synchronization	±50 µsec
Data storage capacity	16 M Bytes (up to 8,000,000 data points)
Operating Parameters	
Wireless communication range	Outdoor/line-of-sight: 2 km (ideal)*, 800 m (typical)**, Indoor/obstructions: 50 m (typical)**
Radio frequency (RF) transceiver carrier	License-free 2.405 to 2.480 GHz with 16 channels
RF transmit power	Adjustable from 0 dBm to 20 dBm. Power output restricted regionally to operate within legal limits
Power source	3 x 3.6 V, ½ AA batteries (Saft LS 14250 recommended)
Battery input range	0.8 V to 5.5 V
Battery lifetime	https://microstrain.com/wireless/G-link-200
Operating temperature	-40°C to +85°C
Mechanical Shock Limit	1000g/1.5ms***
Integration	
Compatible Gateways	All WSDA gateways
Software	SensorCloud, SensorConnect, Windows 7, 8 & 10 compatible
Software development kit	http://www.microstrain.com/software/mscl
Regulatory compliance	FCC (USA), IC (Canada), CE (European Union, includes RoHS), MIC (Japan), IMDA (Singapore).

* Actual range varies with conditions.

** Measured with antennas elevated, no obstructions, no RF interferers.

*** Repeated exposure to > 2x full scale can result in permanent damage. See manual for details.

PRODUCT DATA SHEET

V-Link-200: Wireless 8-Channel Analog Input Sensor Node

The V-Link-200 is a versatile wireless sensor with 4 differential and 4 single-ended analog input channels. It includes onboard PGA's, filtering, and a high-resolution ADC for precise measurement of a large range of sensor types, including strain gages, load cells, pressure transducers, and accelerometers.

The MicroStrain wireless sensor networks eliminate the time and complexity of running long sensor wires. They are fast to deploy and provide reliable, lossless data throughput. These networks have been proven to work in demanding industries where reliable data acquisition is critical.

SensorConnect software can be used for device configuration, live data monitoring, and data analysis. SensorCloud is MicroStrain's optional cloud-based platform that optimizes data aggregation, analysis, and alerts for sensor data collected from remote networks.

HIGH PERFORMANCE SENSING

- 4 differential input channels (+/- 156mV)
- 4 single-ended input channels (+/- 10.24V)
- Onboard temperature sensor
- Configurable gain and anti-aliasing filter
- Low noise
- Onboard shunt calibration for strain gages.
- Onboard bridge offset balancing
- Factory installed bridge completion available



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www.microstrain.com

RELIABLE DATA COLLECTION

- Lossless, synchronized, and scalable networks using LXRS and LXRS+ protocol
- Remotely configure nodes and view sensor data using SensorConnect (PC), SensorCloud (web), or MSCL (API library)

CONFIGURE FOR MANY APPLICATIONS

- Report mV or calibrated engineering units
- Continuous, periodic, or event-triggered operation
- Transmit data real-time and/or save to onboard memory
- Up to 4KHz continuous sampling
- Up to 8KHz data logging periodic, or event-triggered sampling

RUGGED

- Polycarbonate enclosure
- Bolt down or DIN rail mounting
- -40C to +85C operating temperature
- 4kV ESD protection

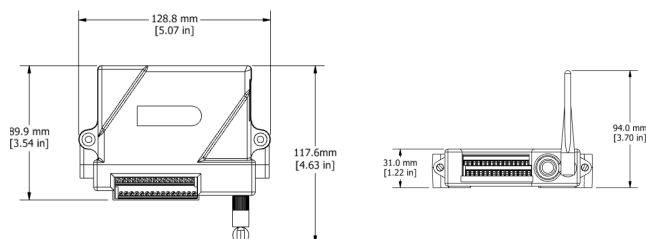
APPLICATIONS

- Strain, load, force, pressure, acceleration, vibration, displacement, or torque sensing
- Condition-based monitoring (CBM)
- Structural load and stress monitoring
- Test and measurement
- Strain gage rosettes

MICROSTRAIN V-LINK-200 SPECIFICATIONS

Analog Input Channels	
Sensor input channels	4 differential 4 single-ended
Integrated sensors	1 temperature sensor
Sensor excitation	4.096V (up to 150 mA)
ADC Resolution	18 bit
Accuracy	± 0.1 % full scale typical
Noise	± 0.02 % full scale
Temperature stability	< 0.1 % full scale over temperature range
Sensor Input bandwidth	DC to 4KHz
Differential Input Channels	
Adjustable Gain	16 to 2048*
Sensor Input Range	+/- 1.22 mV to 156 mV
Anti-aliasing Filter	128 Hz to 4 KHz, 2nd order Butterworth
Strain Calibration	Onboard shunt resistor used for deriving linear strain calibration coefficients
Shunt Calibration	499k Ohm (+/- 0.1%)
Single-ended Input Channels	
Sensor Input Ranges	±2.56Vdc, ± 5.12Vdc, ±10.24Vdc, 0-5.12Vdc, 0-10.24Vdc
Anti-aliasing filter	-3dB @ 15KHz
Input Impedance	1M Ohm
Integrated Temperature Sensor	
Anti-aliasing filter	-3dB, 15KHz
Resolution	0.10°C

[*] Gain levels greater than 512 may not be usable when using the 350Ω ¼ bridge variant of the V-Link-200



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Sampling	
Output Options	mV, ADC counts, or calibrated engineering units
Sampling Modes	Continuous, periodic, and event triggered
Sampling Rates	Continuous sampling: 1 sample/hr to 4 KHz Periodic burst sampling: 32 Hz to 8 kHz Event triggered: 32 Hz to 8 kHz
Network capacity	Up to 128 nodes per gateway LXRS: 4096 Samples/second per gateway LXRS+: 16k Samples/second per gateway https://www.microstrain.com/configure-your-system
Data Storage Capacity	16MB (5M data points with 18 bit data type)
Node Sync	± 50 uSec
Operating Parameters	
Battery power	+6.0 to +18.9Vdc. Recommend 4x 3.6Vdc, 2.4Ah Lithium
Battery lifetime	https://www.microstrain.com/wireless/v-link-200
External power	+7.5 to +36 Vdc
Wireless range	External antenna: 1.5km max, 800m typical. Indoor/obstructed: 100m typical
Radio frequency (RF) transceiver carrier	2.405 to 2.480 GHz, 16 channels, license-free
RF transmit power	User-settable 0 dBm to 20 dBm (restricted regionally)
Operating temperature	-40°C to +85°C
ESD Withstand	4kV
Mechanical Shock Limit	250g/1.5mS with batteries; 500g/1.5mS without batteries installed
Physical Specifications	
Dimensions	129 mm x 117.6 mm x 31 mm (including antenna)
Interface	Screw-down terminal
Weight	283 grams (with batteries), 217 grams (without batteries)
Integration	
Compatible gateways	All WSDA gateways
Software	SensorCloud, SensorConnect, Windows 7, 8 & 10 compatible
Software development kit	http://www.microstrain.com/software/mscl
Regulatory compliance	FCC (USA), IC (Canada), CE (European Union), MIC (Japan), ROHS, IMDA (Singapore)



LASER DEFLECTOMETER



Operating Instructions **optoNCDT ILR2250**

ILR2250-100
ILR2250-100-H
ILR2250-100-IO

3.4 Technical Data

Model			ILR2250-100		ILR2250-100-H		ILR2250-100-IO	
Item number			7112015		7112015.200		7112016	
Measuring range ¹	black 6 %	SMR	0.05 m					
		EMR	30 m					
	gray 40 %	SMR	0.05 m					
		EMR	70 m					
	white 80 %	SMR	0.05 m					
		EMR	100 m					
	Reflector film ²	SMR	35 m					
		EMR	150 m					
Measuring rate			20 Hz					
Resolution			0.1 mm					
Linearity			< ±1 mm ³					
Repeatability ⁴			< 300 μm					
Temperature compensation			-10 ... +50 °C		-40 ... +65 °C		-10 ... +50 °C	
Light source			Semiconductor laser < 1 mW, 655 nm (red)					
Typ. service life			50,000 h					
Laser class			Class 2 according to DIN EN 60825-1: 2014					
Permissible ambient light			50,000 lx					
Supply voltage			10 ... 30 VDC		24 ... 30 VDC		10 ... 30 VDC	
Power consumption			< 1.5 W (24 V)		< 10 W (24 V)		< 1.5 W (24 V)	
Signal input			Trigger				-	
Digital interface			RS422 / USB ⁵ / PROFINET ⁵ / EtherNet/IP ⁵				O-Link 1.1; process data, parameter set up, diagnostics	
Analog output			4 ... 20 mA (16 bit, freely scalable within measuring range)				-	
Switching output			Q1 / Q2 / Q3 (configurable)				Q1 / Q2 / Q3 (configurable) included in IO-Link process data	
Connection			Supply/signal: 12-pin M16 screw/plug connection (see accessories for connection cable)				Supply/signal: 5-pin M12 screw/plug connection (see accessories for connection cable)	
Mounting			Screwing and adjustment on sensor base plate					
Temperature range	Storage		-25 ... +70 °C (non-condensing)					
	Operation		-10 ... +50 °C (non-condensing)		-40 ... +65 °C (non-condensing)		-10 ... +50 °C (non-condensing)	
Shock (DIN-EN 60068-2-29)			15 g / 6 ms in 3 axes, in 3 directions, 1000 shocks each					
Vibration (DIN-EN 60068-2-6)			15 g / 10 ... 500 Hz in 3 axes, 10 cycles each					
Protection class			IP65 (DIN-EN 60529)					
Material			Aluminum housing					
Weight			approx. 265 g		approx. 270 g		approx. 265 g	
Control and display elements			5x LEDs for power, signal strength, switching outputs		5x LEDs for power, signal strength, heating, switching outputs		5x LEDs for power, signal strength and switching outputs	
Features			4 measurement-specific operating modes via sensorTOOL				4 measurement-specific operating modes via IO-Link	

SMR = Start of measuring range, EMR = End of measuring range

The specified data apply for a consistent room temperature of 20 °C, sensor is continuously in operation. Measured on white, diffuse reflecting surface (reference ceramic)

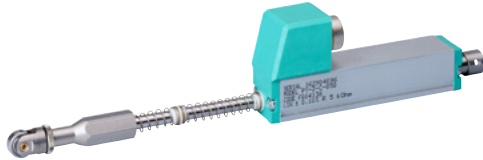
1) Depends on the reflectivity of the target, ambient light interference and atmospheric conditions

2) ILR-RF210 reflector film 210 x 297 mm; art. 7966058

3) Measured in the range of 0.05 ... 20 m; statistical spread 2σ

4) Measurement frequency of 20 Hz, moving average 10

5) Connection via interface module, see accessories



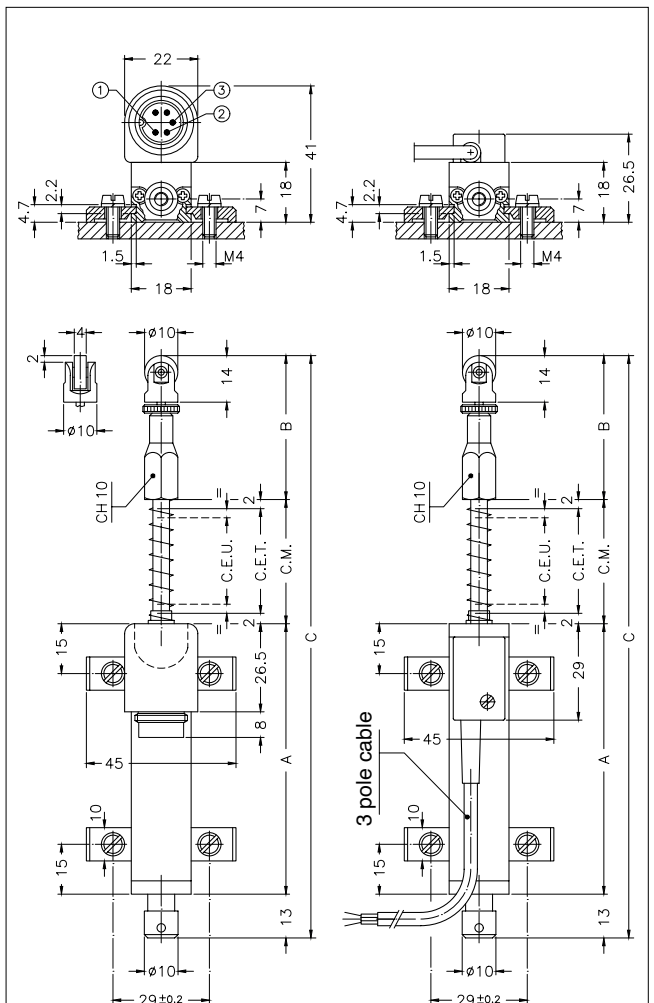
Principal characteristics

- The side connection creates a through-rod structure with double rod support, guaranteeing greater overall strength of the transducer.
- The return spring automatically returns the rod to zero position, making the transducer suitable for comparator applications.
- The tip with roller bearing is suitable for applications where the object to be measured may be subject to shifts transverse to the transducer axle (shaft is prevented from rotating).
- Ideal for checking the flatness or thickness of panels of various materials. Can also be used for valves or mechanical parts when the rod cannot be attached to the moving object.

TECHNICAL DATA

Useful electrical stroke (C.E.U.)	from 10 to 100 mm (for intermediate strokes see table "Electrical / Mechanical Data")
Resolution	Infinite
Independent linearity (within C.E.U.)	see table
Displacement speed	≤ 10 m/s
Displacement force	≤ 4 N
Protection level	IP40
Life	$>25 \times 10^6$ strokes, or 100×10^6 operations, whichever is less (within C.E.U.)
Vibrations	5...2000Hz, $A_{max} = 0,75$ mm $a_{max} = 20$ g
Shock	50 g, 11ms.
Tolerance on resistance	$\pm 20\%$
Recommended cursor current	$< 0,1 \mu A$
Maximum cursor current	10mA
Maximum applicable voltage	see table
Electrical isolation	$>100M\Omega$ a 500V~, 1bar, 2s
Dielectric strength	$< 100 \mu A$ a 500V~, 50Hz, 2s, 1bar
Dissipation at 40°C (0W at 120°C)	see table
Actual Temperature Coefficient of the output voltage	$< 1,5ppm/^{\circ}C$
Working temperature	-30...+100°C
Storage temperature	-50...+120°C
Case material	Anodised aluminium Nylon 66 G 25
Control rod material	Stainless steel AISI 303
Fixing	Brackets with variable longitudinal axis

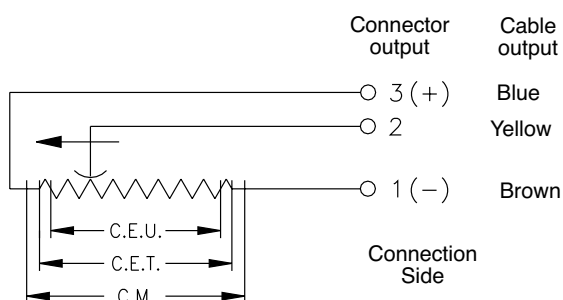
MECHANICAL DIMENSIONS



MECHANICAL / ELECTRICAL DATA

Model		10	25	50	75	100
Useful electrical stroke (C.E.U.) +1/-0	mm	10	25	50	76	101
Theoretical electrical stroke (C.E.T.) ±1	mm	C.E.U. +1				
Resistance (C.E.T.)	kΩ	1		5		
Independent linearity (within C.E.U.)	± %	0.3	0.2	0.07	0.1	
Dissipation at 40° (0W at 120°C)	W	0.2	0.6	1.2	1.8	2.4
Maximum applicable voltage	V	14	25	60		
Mechanical stroke (C.M.)	mm	C.E.U. + 5				
Case length (A)	mm	C.E.U. + 38				
Tip length (B)	mm	43		51		
Total length (C)	mm	119	149	207	262	318

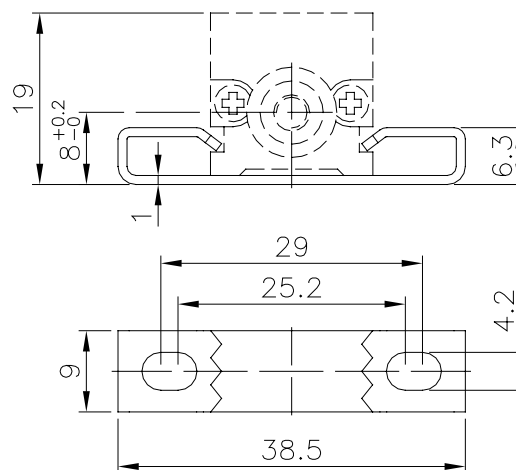
ELECTRICAL CONNECTIONS



INSTALLATION INSTRUCTIONS

- Respect the indicated electrical connections (DO NOT use the transducer as a variable resistance)
- When calibrating the transducer, be careful to set the stroke so that the output does not drop below 1% or rise beyond 99% of the supply voltage.

OPTIONAL FIXING KIT PKIT006



ORDER CODE

Displacement transducer **PY3**

3 pole PVC cable output 3x0.25 1m	F
5 pole connector output DIN 43322	C

Model

S **M**

**Cable length
(in metres)**

This part of the code only applies to the model with cable output

No certificate attached	0
Linearity curve to be attached	L

Standard mounting brackets (PKIT005)	X
Optional mounting brackets (PKIT006)	S

Color of plastic heads (green)	0
--------------------------------	----------

0 0 0 X 0 0 0 0 0

Ex.: **PY3 - C - 50**

Displacement transducer model PY3, 5-pole connector output, useful electrical stroke (C.E.U.) 50mm.

ACCESSORIES

STANDARD ACCESSORIES

Fixing kit: 4 brackets, M4x10 screws, washer	PKIT005
Fixing kit: 2 "wraparound" brackets (0000X000S00 configurator option)	PKIT006
Bearing tip	PTAS001

OPTIONAL ACCESSORIES

5-pin axial female PCB connector DIN43322 IP40 clamp for wire $\varnothing 4$ - $\varnothing 6$ mm	CON011
5-pin axial female PCB connector DIN43322 IP65 clamp PG7 for wire $\varnothing 4$ - $\varnothing 6$ mm	CON012
5-pin 90° radial female PCB connector DIN43322 IP40 clamp for wire $\varnothing 4$ - $\varnothing 6$ mm	CON013

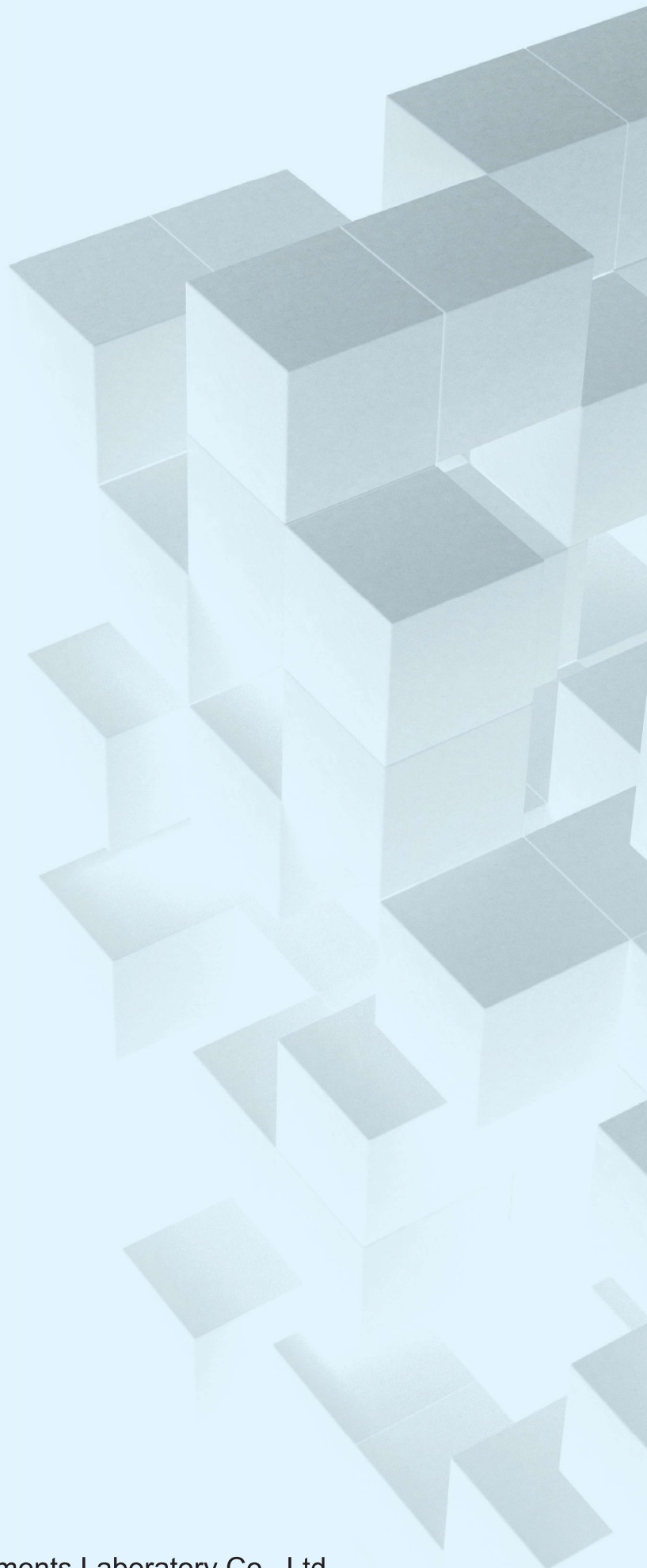
GEFRAN spa reserves the right to make any kind of design or functional modification at any moment without prior notice



STRAIN GAUGES

2023 / 2024

Precise & Flexible





STRAIN GAUGE SELECTION

Strain Gauge Characteristics

Strain gauge series (usage)	Shape	Objective material for measurement	Applicable coefficient of linear thermal expansion (×10 ⁻⁶ /°C)	Operating temperature range (°C)	Temperature compensation range (°C)	Main applicable adhesive	Material		RoHS2 Directive compliance	
							Backing	Grid		
Strain gauge for general use										
F GOBLET	Single/Multi-axis	Metal Glass Ceramic	8,11,17,23	−196~+150°C	+10~+100°C	CN,P-2 EB-2	Special plastics	Cu-Ni	CE marked	
F	Stress concentration Shearing/Torque	Metal Glass Ceramic	8,11,17,23	−196~+150°C	+10~+100°C	CN,P-2 EB-2	Special plastics	Cu-Ni	CE marked	USING AT SITE
Strain gauge with waterproof construction										
WF	Single/Multi-axis	Metal Glass Ceramic	11,17,23	0~+80°C	+10~+80°C	CN,P-2	Epoxy	Cu-Ni	CE marked	
Strain gauge for high temperature use										
QF GOBLET	Single/Multi-axis	Metal Ceramic	11,17,23,28	−30~+200°C	+10~+100°C	CN,C-1 NP-50B	Polyimide	Cu-Ni	CE marked	
QF	Stress concentration Shearing/Torque	Metal Ceramic	11,17,23,28	−20~+200°C	+10~+100°C	CN,C-1 NP-50B	Polyimide	Cu-Ni	CE marked	
ZF	Single/Multi-axis	Metal Ceramic	11,17,23	−20~+300°C	+10~+100°C	CN,C-1 NP-50B	Polyimide	Ni-Cr	Not applicable (high melting point solder) CE marked	
EF	Single	Metal	11	−196~+300°C	+10~+150°C	CN,C-1 EB-2 NP-50B	Polyimide	Ni-Cr	Not applicable (high melting point solder) CE marked	
	Multi-axis			−196~+200°C	0~+150°C				Not compliant	
HZF	Single	Metal	11,17,23	−196~+350°C	+10~+300°C	C-1 NP-50B	Polyimide	Ni-Cr	CE marked	
Strain gauge for high and low temperature use										
CEF	Single	Metal Ceramic	11,17,23	−269~+200°C	−196~+80°C *1	CN,C-1 EA-2A	Polyimide	Special alloy	Not applicable (high melting point solder) CE marked	
Strain gauge for cryogenic temperature use										
CF	Single/Multi-axis	Metal Ceramic	11,17,23	−269~+80°C	−196~+80°C *1	CN,C-1 EA-2A	Special plastics	Special alloy	Not applicable (high melting point solder) CE marked	
Weldable strain gauge										
AWM	Single	Metal	1 1,17	−196~+300°C	RT~+300°C	Spot welding	SUS304 Inconel 600	Special alloy	CE marked	
AWMD	Single	Metal	12	−196~+800°C	*****	Spot welding	Inconel 600	Special alloy	CE marked	
AWH	Single	Metal	1 1,17	−196~+650°C *2	RT~+600°C	Spot welding	SUS304 Inconel 600	Special alloy	CE marked	
AWHU	Single	Metal	1 1	−196~+800°C	RT~+800°C	Spot welding	Inconel 600	Special alloy	CE marked	
AW-6	Single	Metal	1 1	−196~+300°C	+10~+100°C	Spot welding	SUS304	Special alloy	Not applicable (high melting point solder) CE marked	
AWC-8B	Single	Metal	1 1	−20~+100°C	+10~+100°C	Spot welding	SUS304	Special alloy	Not compliant	
Strain gauge for concrete and mortar										
P	Single/Multi-axis	Concrete Mortar	11	−20~+80°C	+10~+80°C	CN-E RP-2,PS	Polyester	Cu-Ni wire	CE marked	
PF	Single/Multi-axis	Metal Mortar	11	−20~+80°C	+10~+80°C	CN-E RP-2,PS	Polyester	Cu-Ni	CE marked	
FLM/WFLM	Single	Concrete Mortar	11	−20~+80°C	+10~+80°C	PS	SUS304	Ni-Cr	Not compliant	
Mold strain gauge										
PMF	Single	Concrete Mortar	*****	−20~+60°C	*****	Embedment	Special plastics	Cu-Ni	Compliant with Option -F	
PMFLS	Single	Asphalt	*****	−20~+60°C	*****	Embedment	Special plastics	Cu-Ni	Compliant with Option -F	

*1: Approximately temperature compensated range *2: Up to +600° C for static measurement, Up to +650° C for dynamic measurement

		Strain limit in room temperature ($\mu\epsilon$)	Fatigue life Strain level Number of cycles	Description	See page
	F	5% (50,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These are CE marked strain gauges (compliant to RoHS2 Directive) for general use having a new series name "GOBLET". They have joined to our well proven F-series general-use strain gauges. CE marked leadwires are also available in combination with the strain gauges.	42
	F	5% (50,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These are foil strain gauges for general use having expanded operating temperature range of -196 to +150°C by the employment of special plastics backings. The backing is color coded to identify the objective material for self temperature compensation. Strain gauges using lead-free solder are available with option code -F. Various leadwires are also available for this series to meet diverse measurement conditions.	45
	WF	3% (30,000)	$\pm 1,500\mu\epsilon$ 3×10^4	These are F-series strain gauges with integral vinyl leadwires. Whole area of the strain gauge and the leadwire junction are coated with epoxy resin for water proofing. The coating is transparent and flexible, so the positioning and bonding works are very easy. By merely bonding the gauge with an adhesive, outdoor or underwater measurement for a short-term becomes possible.	47
	OF	3% (30,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These are CE marked strain gauges (compliant to RoHS2 Directive) with backings made of polyimide resin. They are suited to strain measurement in high temperature up to 200°C. They are also used for strain gauge type transducers such as load cells.	48
	OF	3% (30,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These are strain gauges utilizing polyimide resin as the backing material. They are suited to strain measurement in high temperature up to 200°C. They are also used as the strain sensing element in strain gauge type transducers such as load cells.	49
	ZF	1% (10,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These strain gauges utilize specially designed Ni-Cr alloy foil for the grid and polyimide resin for the gauge backing. Owing to the construction, these strain gauges are successfully used for measurement in high temperature up to 300°C.	50
	EF	1% (10,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These are extremely small strain gauges enabling strain measurement in narrow space. Single element gauge is applicable to measurement in high temperature up to 300°C. Two or three element gauge is applicable to measurement up to 200°C. In cryogenic temperature range, all gauges are applicable down to -196°C.	51
	HZF	1% (10,000)	$\pm 1,500\mu\epsilon$ 1×10^6	This adhesive-type high-temperature strain gage is capable of measuring temperatures up to 350°C. It is RoHS compliant because of the welded connection of dedicated leads. And the C-1 adhesive can be used up to 350°C for one short cycle.	51
	CEF	1% (10,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These strain gauges feature a wide range of operating temperature from cryogenic temperature to +200°C. They utilize polyimide resin for the gauge backing. This series is available only in single axis configuration with gauge length of 1,3 and 6mm.	52
	CF	1% (10,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These are strain gauges designed for measurement in cryogenic temperature. They are available in single element, 2-element and 3-element configurations with 350Ω resistance. The thermal output is stable even under cryogenic conditions.	53
	AWM	1% (10,000)	$\pm 1,000\mu\epsilon$ 1×10^6	This strain gauge has a strain sensing element fully encapsulated in a metal tube. The connection method is quarter bridge 3-wire. It is suited to measurement in high temperature up to 300°C and/or in harsh environment. This strain gauge is installed using our spot welder W-50RC.	55
	AWMD	1% (10,000)	$\pm 1,000\mu\epsilon$ 1×10^6	This strain gauge has a sensing element of quarter bridge 3-wire connection which is fully encapsulated in a metal tube. It is measured in full bridge method using the attached high pass filter. It is suited to measurement in high temperature up to 800°C and/or in harsh environment. This strain gauge is applicable only for dynamic strain measurement using DC exciting dynamic strain meter. It is installed using our spot welder W-50RC.	55
	AWH	0.6% (6,000)	$\pm 1,000\mu\epsilon$ 1×10^6	The sensing element is made of special alloy and is fully encapsulated in a corrosion-resistant metal tube such as Inconel 600. The sensing part has half bridge configuration with active element and dummy element, and it is measured in full bridge method using the attached temperature compensation circuit board. This gauge is suited to static measurement in high temperature up to 600°C (650°C for dynamic measurement). It is applicable to use in various environment including gas or liquid. Installation is made using our spot welder W-50RC.	56
	AMHU	1% (10,000)	$\pm 1,000\mu\epsilon$ 1×10^6	The sensing element is made of special alloy and is fully encapsulated in a corrosion-resistant metal tube such as Inconel 600. The sensing part has half bridge configuration with active element and dummy element, and it is measured in full bridge method using the attached temperature compensation circuit board. This gauge is available for use in high temperature up to 800°C for both of static and dynamic measurement. It is applicable to use in various environment including gas or liquid. Installation is made using our spot welder W-50RC.	56
	AWG	0.5% (5,000)	$\pm 1,000\mu\epsilon$ 1×10^6	The construction of this strain gauge is that a high temperature strain gauge is bonded on a thin stainless steel sheet (0.08mm thick) with heat-curing adhesive. Strain measurement in temperature up to 300°C is possible by this strain gauge. It is suited to measurement of a specimen on which strain gauge bonding is not possible, and/or to a long term measurement. Installation is made using our spot welder W-50RC.	57
	AWC	0.5% (5,000)	$\pm 1,000\mu\epsilon$ 1×10^6	The sensing element of this strain gauge is encapsulated in a stainless steel tube with adhesive. Owing to the sealed construction, this strain gauge is suited to measurement under water and/or for a long term. It is installed by spot welding the stainless steel backing using our spot welder W-50RC.	57
	P	2% (20,000)	$\pm 1,000\mu\epsilon$ 1×10^5	These strain gauges utilize a thin wire as the sensing element and have comparatively long gauge lengths. They are mainly used for measurement on concrete. Since the backing is transparent, the bonding position can easily be checked in the installation works. Strain gauges with integral leadwires are available with CE marking.	59
	PF	2% (20,000)	$\pm 1,500\mu\epsilon$ 1×10^6	These strain gauges have polyester resin backings which are the same as P series, while they have sensing elements made of foil. They can be handled as easily as P series gauges. They are applicable to various materials including concrete, mortar and metals. Strain gauges with integral leadwires are available with CE marking.	60
	FLM/WFLM	0.5% (5,000)	$\pm 1,000\mu\epsilon$ 1×10^5	These strain gauges have resin backings lined with metal foil for the purpose of preventing the penetration of moisture from the reverse side. They are exclusively used for the measurement of strain on concrete surface. The WFLM gauges have moisture proofing over-coating and integral leadwire in addition to the metal backing. It is suited to long term measurement or measurement on underwater-curing concrete.	61
	PMF	****	****	These gauges are designed for measurement of internal strain of concrete or mortar. They are embedded into the measurement position when the concrete or mortar is placed. These gauges are exclusively used for short term measurement such as a loading test. For long term measurement, the use of strain transducer [KM] is recommended. (see page 63-64)	62
	PMFLS	****	****	This strain gauge utilizes super engineering plastics for the backing material, which exhibit excellent water and heat resistance. It withstands the high temperature of 200°C when the asphalt is placed. This strain gauge is manufactured using lead-free solder with option code -F.	62

Q.bloxx A116

Multichannel Bridge Measurement Module



The Q.series has been designed for demanding measurements found in today's most industrial measuring and testing environments. The range of applications starts from single stand-alone solutions up to networked multi-channel applications in the field of component testing, engine testing, process performance testing and structural monitoring.

The range and flexibility of the modules allows an optimized solution for each single task:
Dynamic signal acquisition up to 100 kHz, inputs and outputs for all types of signals, galvanic isolation of inputs and outputs, multi-channel solutions, high density packaging and intelligent signal conditioning.

Data exchange between Test Controller and automation level is communicated via Ethernet TCP/IP or fieldbus systems like EtherCAT or Profibus-DP and additional Ethernet-based industrial standards.

Most important features:

- **8 analog input channels for bridges**
strain gauge bridges (full, half, quarter)
8 real parallel inputs, neither scanned nor multiplexed
- **Flexible Input**
DC bridge excitation 2 V and 4 V
input range 1 mV/V and 5 mV/V, 2.5 mV/V and 10 mV/V
- **Fast high accuracy digitalization**
24 bit ADU, 10 kHz sample rate per channel
- **Signal conditioning**
linearization, digital filter, average, scaling,
min/max storage, arithmetic, alarm
- **Shunt calibration signal per channel**
- **Connectable to any Test Controller**
e.g. Q.gate, Q.pac or Q.station
- **Compatible with all Q.series modules**
e.g. for displacement, temperature, counter, voltage, current,
resistance, frequency, I/O
- **Galvanic isolation**
channel to power supply and to interface
Isolation voltage 500 VDC
- **RS485 fieldbus interface**
up to 48 Mbps: LocalBus
up to 115.2 kbps: Modbus-RTU, ASCII
- **Electromagnetic Compatibility**
according EN 61000-4 and EN 55011
- **Power supply 10...30 VDC**
- **DIN rail mounting (EN 60715)**

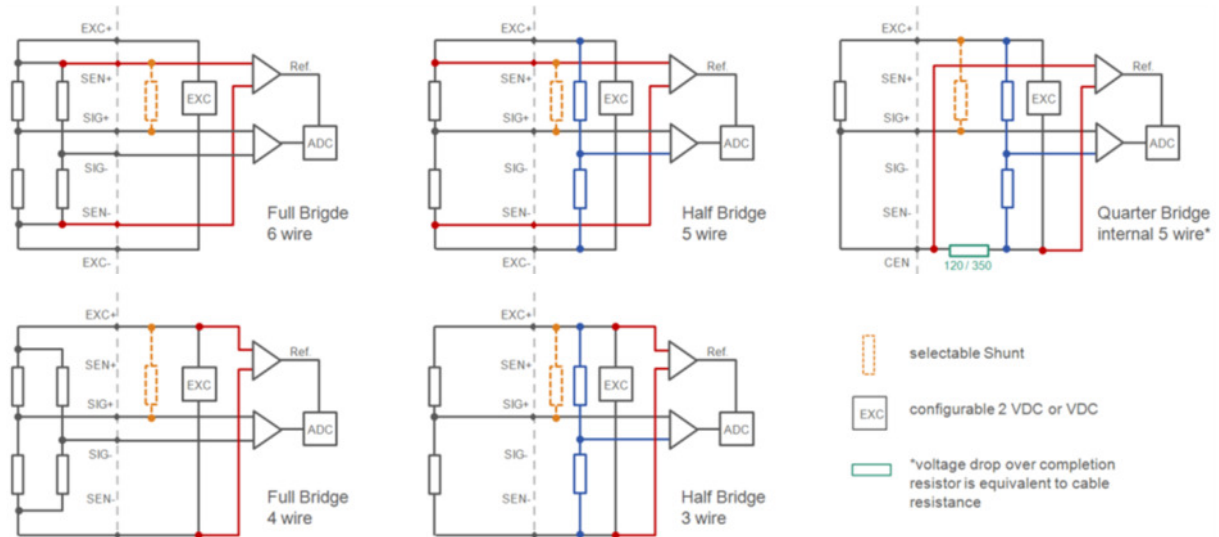




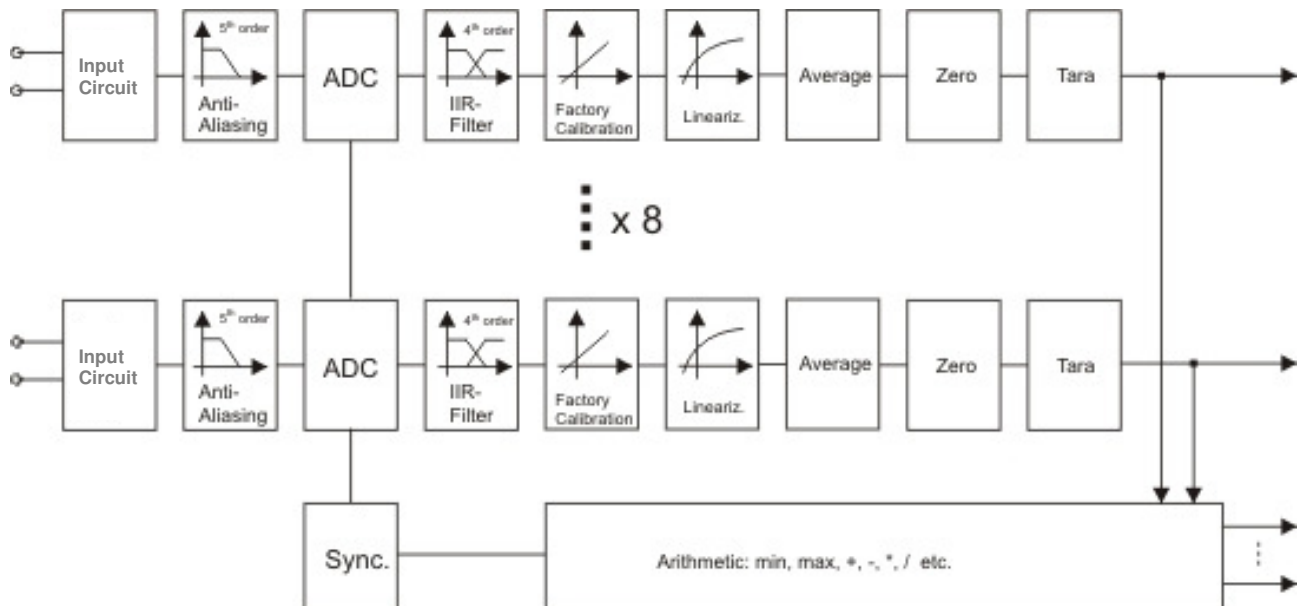
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Multichannel Bridge Measurement Module

Input Circuit



Block Diagram





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Multichannel Bridge Measurement Module

Analog Inputs	
Number	8
Accuracy	0.02 % typical
	0.05 % in controlled environment ¹
	0.1 % in industrial area ²
Repeatability	0.01 % typical (within 24 h)
Input resistance	>10 MΩ
Isolation voltage	500 VDC channel to power supply to interface ³
Sensor type	resistive full bridge (4/6 wire), resistive half bridge (3/5 wire), resistive quarter bridge 120 Ω and 350 Ω (3 wire incl. cable compensation)
Bridge completion resistor	120 Ω und 350 Ω, temperature stability 0.05 ppm / K
Permitted sensor cable length	<300 m full and half bridge, <100 m quarter bridge
Sensor excitation	2 VDC and 4 VDC selectable
Permitted sensor resistance	full bridge >300 Ω, half bridge >200 Ω, quarter bridge >100 Ω
Shunt Calibration	Internal resistor 100 kΩ, V _{exc+} - V _{sig+}
Measuring range full and half bridge	±2,5 mV/V and ±10 mV/V
Measuring range quarter bridge	±1 mV/V and ±5 mV/V
Temperature influence on zero	<0.2 μV/V / 10 K
Temperature influence on sensitivity	<0.05 % / 10 K
Long term drift	<0.2 μV/V / 24 h , <2 μV/V / 8000h
Linearity Error	<0.02 % f.s.
Noise voltage at 10 Hz	<0.3 μV/V

Analog Digital Conversion	
Resolution	24 bit
Sample rate	10 kHz
Conversion method	Sigma-Delta (group delay time 600 μs)
Anti-aliasing Filter	1 kHz 3 rd order
Digital filter	IIR, low pass, high pass, band pass, 4 th order, 1 Hz up to 1 kHz in steps 1, 2, 5
Averaging	configurable or automated according the selected data rate

¹ according EN 61326: 2006, appendix B

² according EN 61326: 2006, appendix A

³ noise pulses up to 1000 VDC, permanent up to 250 VDC



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Multichannel Bridge Measurement Module

Power Supply	
Power supply	10 up to 30 VDC, overvoltage and overload protection
Power consumption	approx. 2.5 W
Influence of the voltage	<0.001 %/V

Environmental	
Operating temperature	-20°C up to +60°C
Storage temperature	-40°C up to +85°C
Relative humidity	5 % up to 95 % at 50°C, non condensing

Communication Interface	
Standard	RS-485, 2-wire
Data format	8e1
Protocols	Local-Bus: 115200 bps up to 48 Mbps
	Modbus-RTU, ASCII: 19200 bps up to 115200 bps
Connectable devices	max. 32

Mechanical	
Case	Aluminum and ABS
Dimensions (W x H x D)	(27 x 120 x 105) mm
Weight	approx. 200 g
Mounting	DIN EN-rail
Sensor Connection	68 pole Harting Har-Mik Connecting cable 1m length is not included and is available as accessory



Warm Up Time

All declarations are valid after a warm up time of 45 minutes.

Valid from Nov. 2012. Specification subject to change without notice
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